COMPARISON OF KANGAROO MOTHER CARE WITH CONVENTIONAL METHOD OF CARE IN THE CARE OF LOW BIRTH WEIGHT INFANTS

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CERTIFICATE

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CONTENTS

COMPARISON OF KANGAROO MOTHER CARE (KMC) WITH CONVENTIONAL METHOD OF CARE (CMC) IN THE CARE OF LOW BIRTH WEIGHT INFANTS (LBWI)

INTRODUCTION

Globally, about 25 million births / year (17%) are of low weight, ,2500 g, >95% in low-income countries[1] · Good quality care of low birth weight infants (LBWI) could reduce neonatal mortality in these countries, but the technologies used in rich countries are too expensive and need often-lacking skilled personnel, maintenance and logistic support. Expensive technologies may also prevent early mother–baby contact and breastfeeding, for survival in low-income countries [2] , and may not allow mothers to become competent and confident in the care of their LBWI.

Global Problem

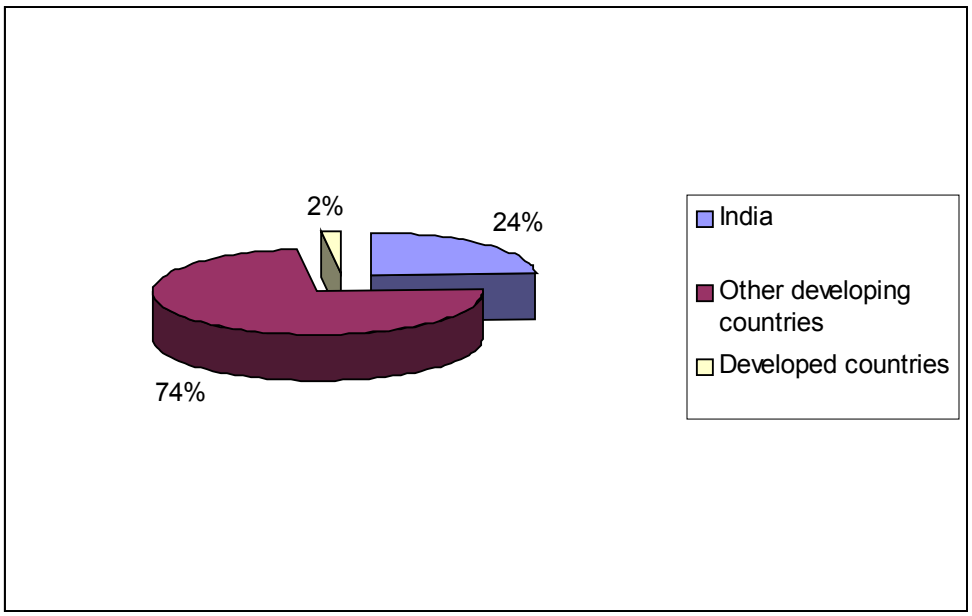
LBW is a global problem particularly in developing countries. LBW and preterm births are associated with high neonatal mortality and morbidity and are public health problems in developing countries.

Approximately 25 million LBW babies are born each year all over the world because of either preterm birth or impaired fetal growth. Of the estimated 4 million neonatal deaths, preterm and LBW babies constitute 20 percent. India's share of the global burden of neonatal deaths is the highest for any single nation. India accounts for 12 lakh of the 50 lakh newborn deaths in the world annually.This is nearly a quarter of

the total global burden of newborn deaths.

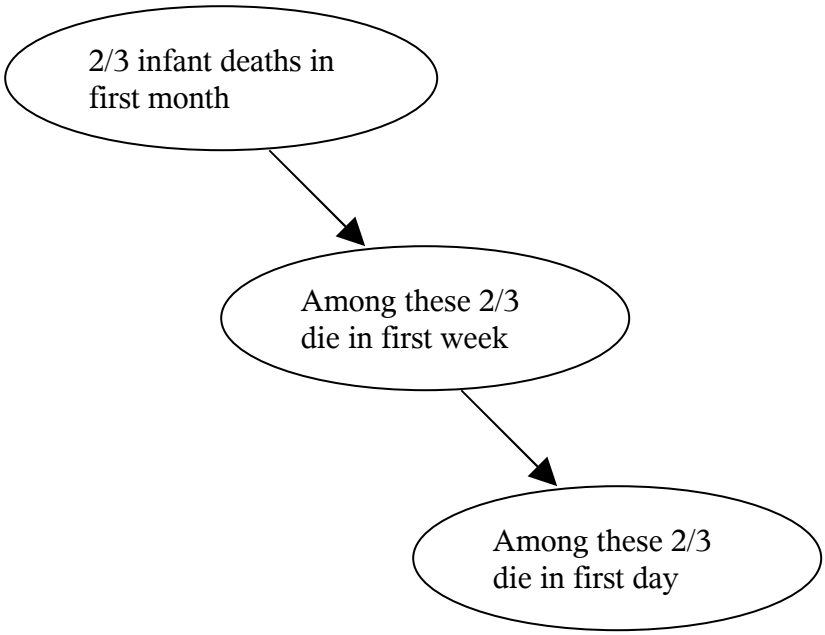
LBW babies therefore represent a burden for the health and social systems globally.

India's share of the global burden of neonatal deaths



Indian scenario

Incidence of LBW is 30-40% which is amongst the highest in the world and nearly 2/3 of neonatal mortality occur in LBW infants.



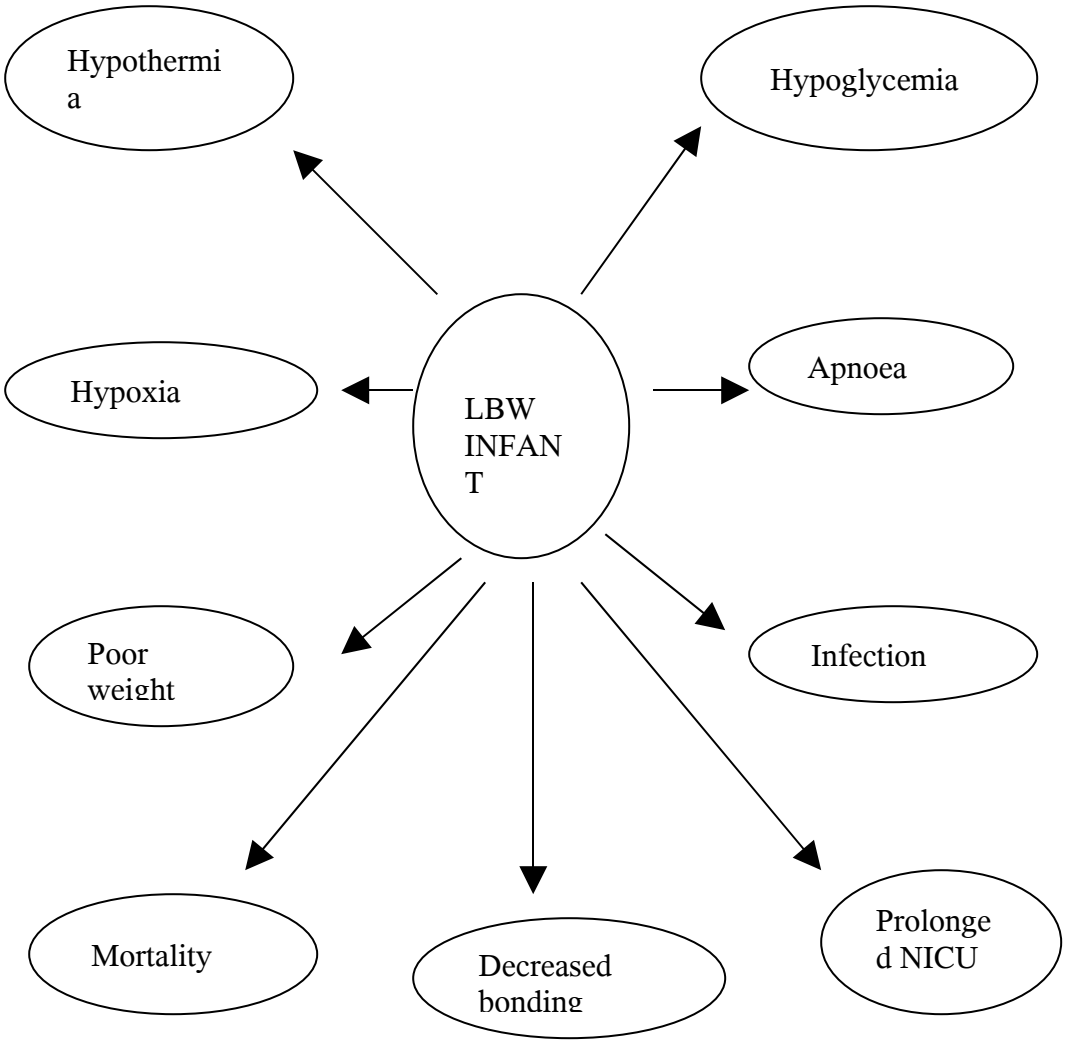
IMR in India is stagnant and varies from 70-80/1000 live births since a decade.

If we wish to bring down the IMR, it is mandatory to reduce the neonatal mortality and morbidity, which constitutes 2/3 of IMR. Improved Survival and care of LBW babies therefore will result in major reduction in infant morbidity and mortality.

Problems of low birth weight babies

Low birth weight infants are prone to multisystemic complications during neonatal period and may have long term implications.

Problems of low birth weight infants



Resuscitation and problems at delivery

Preterm and IUGR babies may required to be delivered by Caesarean section and may be depressed at birth. Premature infants require additional special care in the delivery room like

a) Precautions to prevent heat loss.

b) Respiratory support for apnoea due to respiratory insufficiency which is more likely at lower gestational age.

c) SGA babies are more likely to have asphyxia,meconium stained liquor and needs special precaution to prevent meconium aspiration syndrome.

Temperture Control

The LBW infant is predisposed to hypothermia [3] as

a) They have a higher ratio of skin surface area to weight.

b) They have thin skin with decreased subcutaneous fat, with less insulative capacity.

c) They have limited ability to shiver

d) Their stores of brown fat are less well developed and therefore heat production is less.

e) They are unable to take enough calories to provide nutrients for thermogenesis and growth.

f) Oxygen consumption is limited in some premature infants because of pulmonary problems.

g) There is increased heat loss due to the extended posture and the immature skin.

Consequences of hypothermia

Infants subjected to acute hypothermia respond with peripheral vasoconstriction , causing anaerobic metabolism and metabolic acidosis. Severely hypothermic babies may develop apnoea, bradycardia, hypoglycemia, edema or sclerema, bleeding diathesis especially pulmonary haemorrhage and death.

Thermal neutral range is a narrow range of environmental temperture at which a baby can maintain normal body temperature with minimal oxygen consumption and possibly minimal calorie expenditure.

Temperature maintenance is therefore of prime importance and maintenance of neutral thermal environment reduces the energy expenditure and promotes growth in the LBW infants.

Respiratory problems

Premature infants may adapt poorly to air breathing and present with perinatal depression in the delivery room.

Respiratory distress syndrome may occur because of immaturity of the

mechanisms controlling breathing.

Meconium aspiration syndrome is commonly the result of fetal distress and is frequently associated with small for gestational age babies.

Finally oxygen therapy for respiratory distress needs to be monitored as it has its long term side effects.

Meatabolic problems

Hypoglycemia

Hyponatremia

Hypocalcemia

are common metabolic problems encountered in the LBW infant.

Infections

LBW infants are particularly vulnerable to infections because of

Epidermal barrier immaturity

Poor defence mechanisms

Interventions and procedures carried out for routine monitoring and treatment.

Haematological problems

Polycythemia is common in babies who are small for gestational age.

Anaemia is frequently seen in preterm babies.

Premature babies are more likely to develop hyperbilirubinemia and can develop kernicterus at low levels of bilirubin.

Gastrointestinal problems

Prematurity is the single greatest risk factor for necrotizing enterocolitis.

Feeding problems are common in LBW babies because of immaturity of the suck-swallow-breathing co-ordination.

Neurological problems

LBW babies are more prone for perinatal depression and intracranial bleeds that may have long term implications.

Prolonged NICU stay

Emotional deprivation

Separation of baby and mother while baby is in NICU may lead to decreased bonding and child abandonment,

Decreased bonding: Most parents are overwhelmed but apprehensive to take care of their small babies.

Poor weight gain

The LBW infant frequently show an exaggerated weight loss and slower rate of weight gain in the postnatal period due to

a) inadequate caloric intake

b) frequent illnesses

c) hypothermia

d) occult sepsis

CONVENTIONAL CARE

Care of the LBW infants consists of

a) maintenance of temperature

b) feeding

c) hygiene

In hospital settings, infants less than 2000g are nursed in incubators or radiantv warmers or other heating devices to provide additional environmental heat until they regulate temperature.

Initial nutrition is parenteral, followed by orogastric tube feeds until infants are able to suck and swallow in coordination.

At times two or more infants may need to be placed in the same incubator/

warmer due to large number of babies and scarcity of resources.

Babies even die because of unavailability of neonatal care facility. Conventional care of LBW infants has some disadvantages.

Equipment

High technology based warmers, incubators, apnoea monitors

Too expensive

Liable to shortage

Frequent breakdowns

Electric short supply

Lack of maintenance

Lack of spare parts

Personnel

Needs skilled personnel

Constant shortage

Expensive

Overcrowding

Increase in nosocomial infections

Reduced mother infant bonding

Mothers are less competent and confident

Stress on family

Breastfeeding is insufficiently promoted

Child abuse and abandonment

Scientific evidence suggests that most of the above problems were taken care of when babies were given Kangaroo mother care.

The care of LBW infants in developing countries is a heavy burden on the limited resources of health care. The placement of mother-infant dyad in skin-to-skin contact has been proposed as an alternative method of caring for premature infants in intensive care nurseries where incubators or radiant warmers are used to maintain temperature and optimize growth.

CONCEPT OF KANGAROO MOTHER CARE

Kangaroo mother care (KMC), defined as early, prolonged and continuous skin-to-skin contact between a mother and her newborn LBWI, both in hospital and after early discharge, until at least the 40th week of postnatal gestational age, could help to

overcome most of the constraints of conventional methods of care (CMC).

KMC does not need sophisticated equipment, and for its simplicity it can be applied almost everywhere, including peripheral maternity units of very low-income countries.

KMC could also contribute to the humanization of neonatal care and the containment of cost; for these features, it may also be attractive for neonatal units in high-income countries. Since its first description in 1983 [4], KMC has drawn the attention of international agencies and the scientific community.

The term **kangaroo** is derived from practices similar to marsupial care, in which the infant is kept warm in the maternal pouch and close to the breasts for unlimited feeding. Kangaroo care is defined as skin-to-skin contact between a mother and her low birth weight (LBW) infant in a hospital setting, a practice that originated in Bogota, Columbia to provide tactile, kinaesthetic, and vestibular stimulation and to transmit heat from the parent's to the infant's body. In 1978, Ray and Martinez created the concept of kangaroo mother care at the instituto materno infantil in Bogota, Columbia. This has evolved into a practice that includes frequent breastfeeding. [5] The three major components of Kangaroo mother care are:

1. Kangaroo position: Skin to skin contact

2. Kangaroo feeding policy: Exclusive breast feeding

3. Early discharge and follow- up

Kangaroo position

Skin to skin contact between the mother and the baby, twenty four hours a day, in a strict vertical position, between the breasts of the mother and under her clothes is described as kangaroo position.

Mothers are used as a source of warmth, nutrition and stimulation. The baby's temperature is maintained within normal limits while in kangaroo position, due to heat from the mother's body.

Kangaroo care provider

Mother is the best person to provide kangaroo care. can provide kangaroo mother care, irrespective of age, parity, education, culture and religion .However any other person preferably the father or a close family member can share the role of the mother as a kangaroo care provider for sometime during the day.

Criteria for the kangaroo baby

Currently kangaroo mother care is recommended for LBW infants under minimal care who have,

- **Overcome any existing pathological condition started and tolerating oral feeds**

- Good response to stimuli

- Mother or a suitable person willing to participate in the adaptation programme

Preparation of the kangaroo baby

The kangaroo baby must be suitably dressed in a cap, soak proof diaper, socks, front open shirt/ vest made of soft, natural fiber like cotton.

The baby's chest skin should be exposed, to allow skin-to-skin contact with the mother. There are different methods for placing the baby in skin-to-skin contact with the mother

Kangaroo bag- specially made bag to place the baby

The baby may be secured inside the blouse or lycra bag

Baby may be secured with dupatta or saree pallu

Thermoregulation in neonate

Prevention of hypothermia

Mechanism

Skin temperature during kangaroo mother care is **s**lightly higher than rectal

temperature and it is not associated with increased oxygen consumption suggesting that the skin temperature rises because of conductance of heat from the mother and not as a result of increased heat production in the infant. The clothing protects the baby from evaporative, convective and radiation heat losses.

Risk of hyperthermia seen with incubator/radiant warmer is not seen with KMC.

Concept of thermal synchrony in Kangaroo mother care

Babies in incubator/ radiant warmer care are subjected to swings of temperature. Swings in temperature leads to apnoeic spells and increased caloric expenditure. A baby kept in KMC almost has no swings in temperature and the temperature remains constant at 37^0C.

If baby's temperature in KMC decreases by 1^0C, then temperature of the skin of the mother in contact with the baby goes up by 2^0C to warm up the baby rapidly. If baby's temperature increases by 1^0C, the mother's skin temperature decreases by 1^0C. This phenomenon is called thermal synchrony. Therefore the thermal regulation in KMC is far superior as compared to other means of keeping the baby warm.

BENEFITS OF KANGAROO MOTHER CARE

Kangaroo mother care is a humane low cost method of care of the low birth weight infant and it significantly reduces the neonatal morbidity and mortality.

Benefits of kangaroo mother care is discussed in the following headings:

- ✓ Benefits to the baby
- ✓ Benefits to the mother
- ✓ Benefits to the family
- ✓ Benefits to the hospital
- ✓ Benefits to the nation

Benefits to the baby

The baby is kept warm for 24 hours as the mother is the best incubator.

Kangaroo mother care facilitates physiological stability.

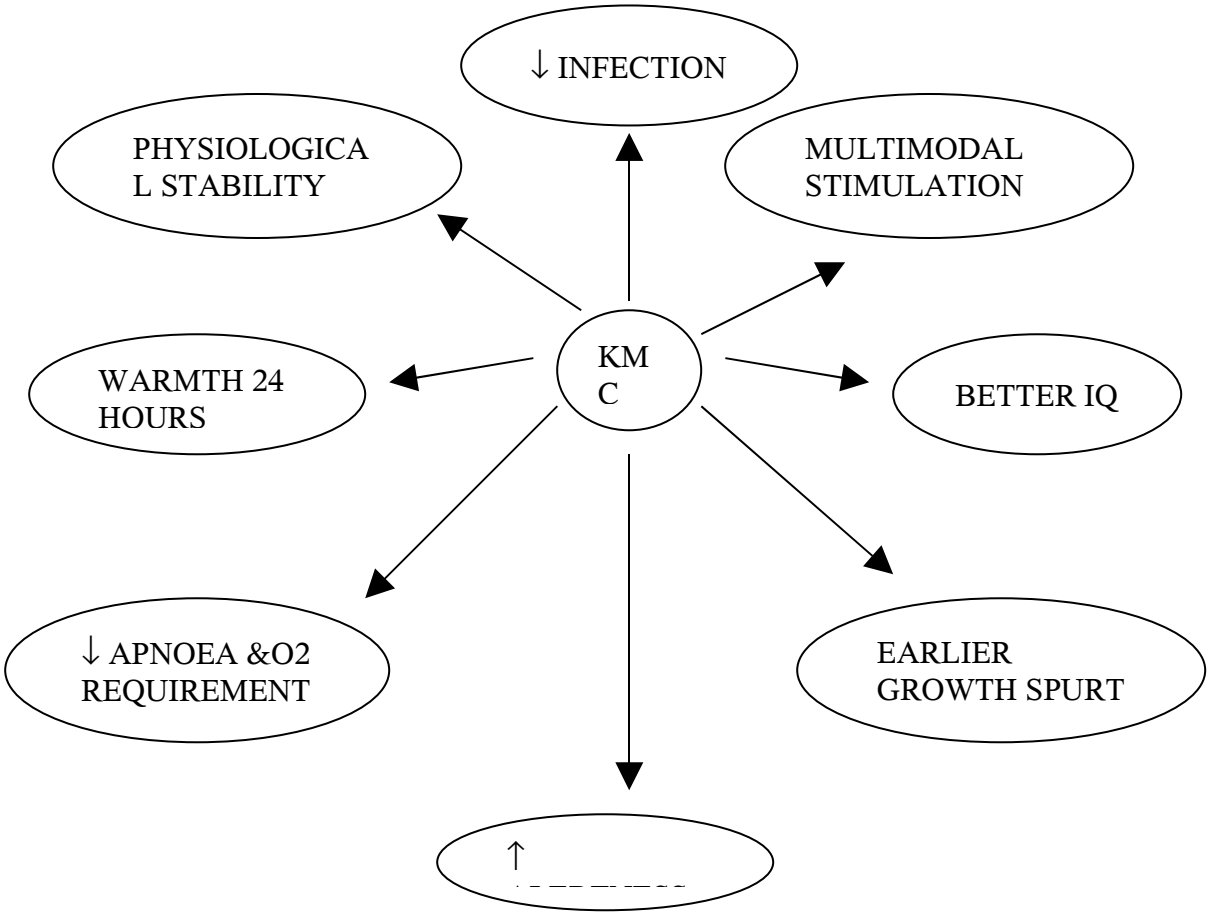
Kangaroo mother care reduces apnoea, oxygen requirement and the risk of infection.

Kangaroo mother care helps in early discharge of babies from NICU thus reducing the risk of nosocomial infection.

Kangaroo mother care improves growth by facilitating earlier growth spurts due to reduced energy expenditure.

Kangaroo mother care increases both alertness and quiet sleep.

It facilitates cognitive development and babies are more intelligent.



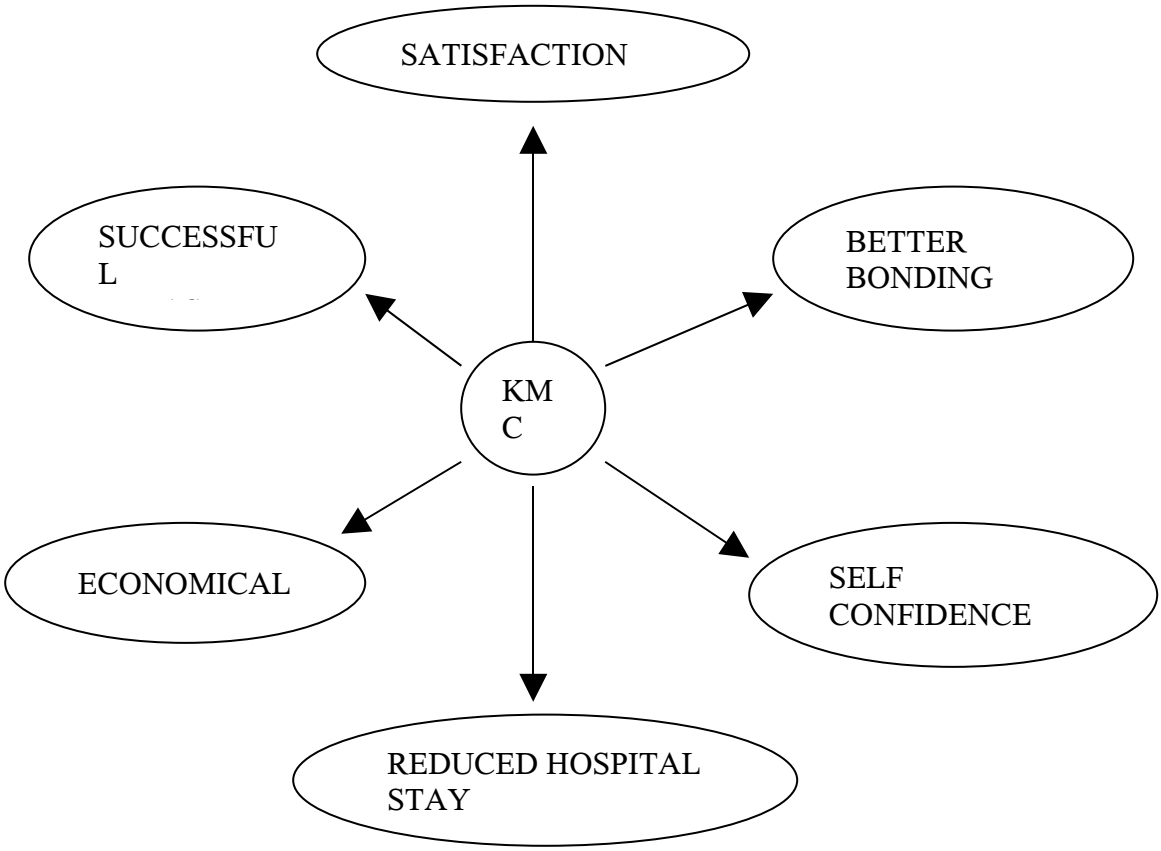
Benefits to the mother

As the mother is more actively involved in care of her baby, she is more relaxed, self confident and empowered.

There is better mother-infant bonding.

Kangaroo mother care improves maternal satisfaction and mother is contended and less stressed.

Kangaroo mother care facilitates and maintains lactation.



Benefits to the family

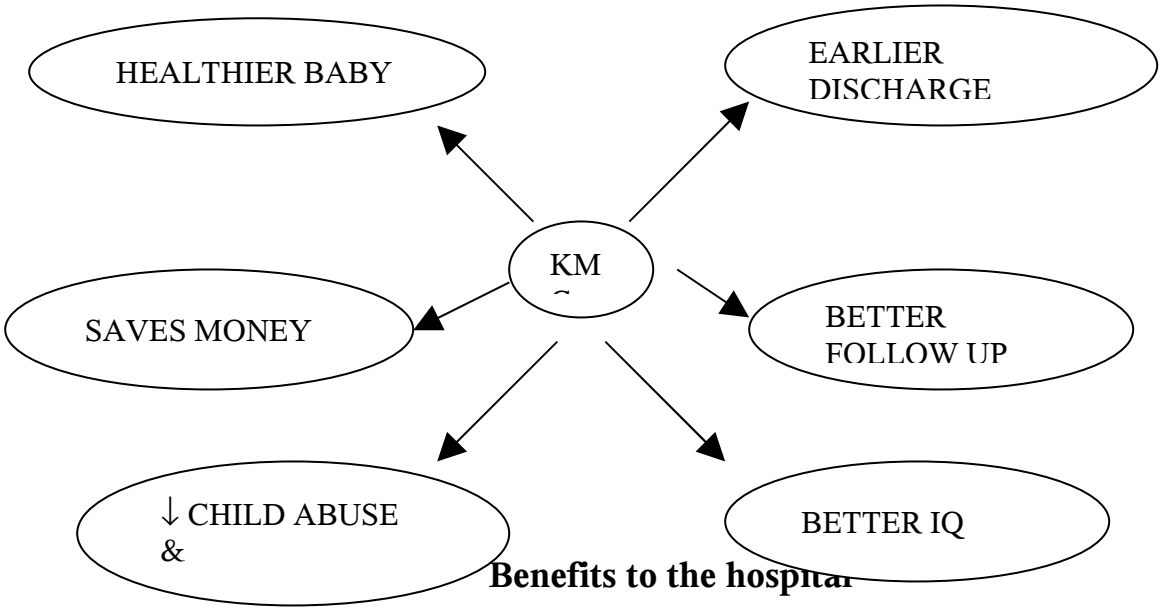
Kangaroo mother care is economical to the family because of early discharge, improved health of the baby and exclusive breastfeeding.

There is better follow-up as the family is more involved with the baby.

Kangaroo mother care facilitates bonding between mother, baby and other family members.

The father is able to return to work earlier.

There is decreased incidence of child abandonment and child abuse.



Benefits to the hospital

Kangaroo mother care saves money on equipment. KMC results in better utilization of resources and scarce incubators and warmers which can be utilized only for the very sick neonates.

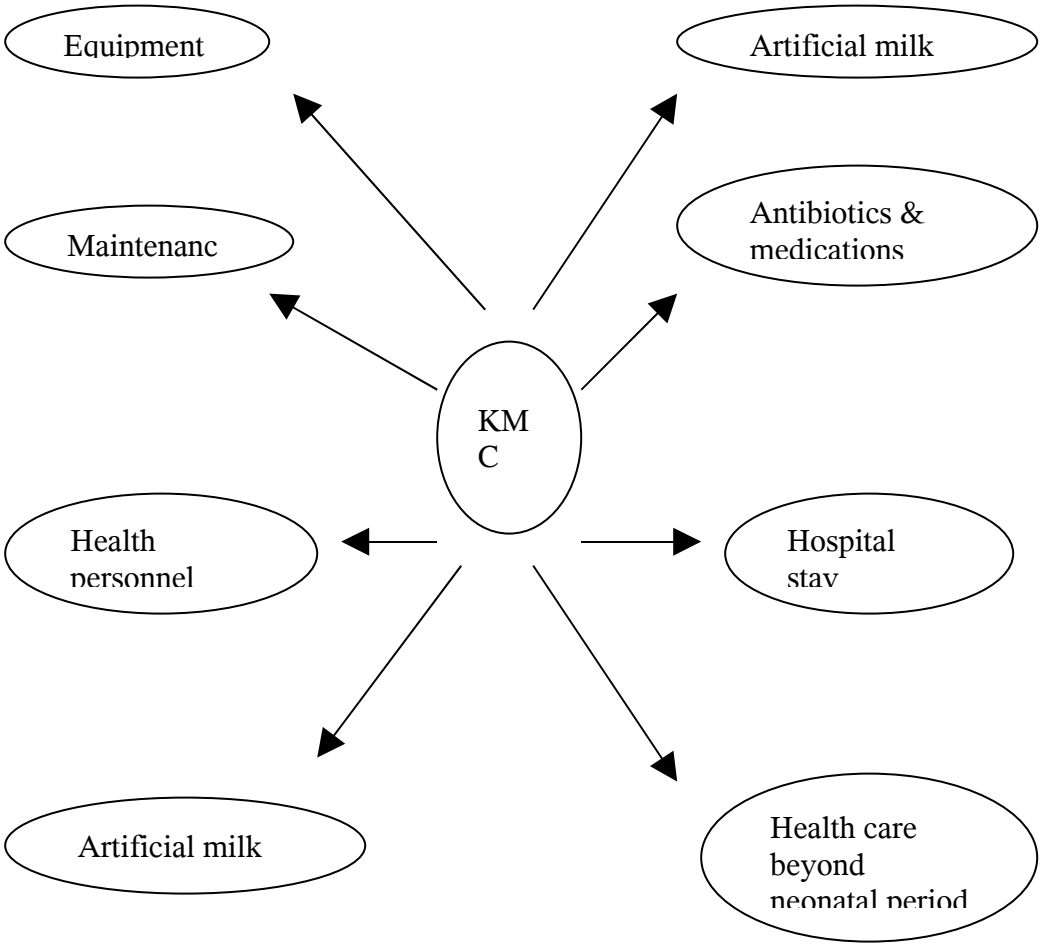
The mother is more involved in the care. Hence baby : nurse ratio can be reduced and there will be less burden of work on staff nurses. KMC will save money on health personnel.

KMC will save money because of early discharge.

KMC babies have less number of infections and other medical problems, hence saving money on antibiotics and other medications.

Exclusive breastfeeding will further save money on artificial milk and formula feeds.

KMC babies have lesser problems during the first year of life. KMC saves money on health care cost of babies even beyond the neonatal period.



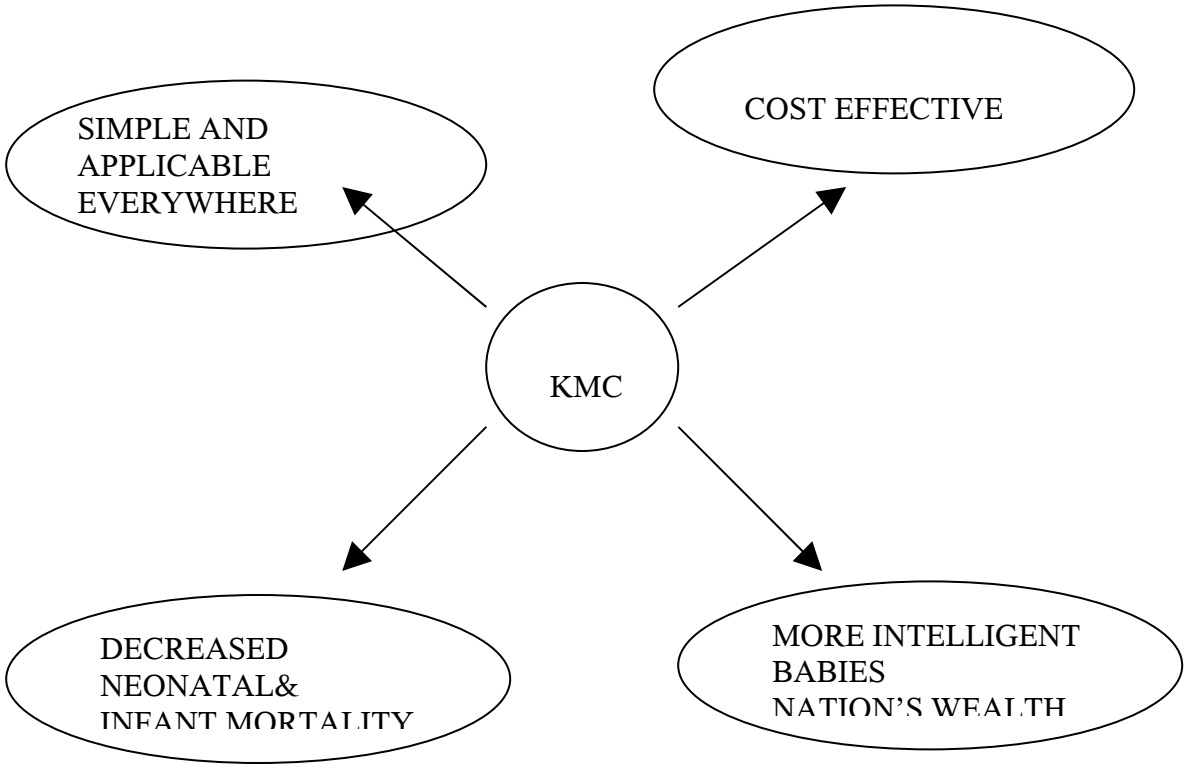
Benefits to the nation

KMC decreases neonatal and infant mortality and morbidity, and therefore there is less burden on the health resources.

KMC is simple, easily applicable, cost-effective and possible even at home where a lot of Indian women deliver.

KMC results in healthier and more intelligent babies and thus adds to the nation's wealth.

KMC decreases expenditure on milk. 135 million lactating cows would be needed to replace the milk produced by the women of India. If all the women in India were to breastfeed, it would save the nation's exchequer close to Rs.7000 crores.



REVIEW OF LITERATURE

Kangaroo mother care for low birth weight infants: a randomized control trial in different settings

Setyowireni D et al conducted a randomized control trial carried out for 1 year in three tertiary and teaching hospitals in Ethiopia, Indonesia and Mexico to study the effectiveness, feasibility, acceptability and cost of kangaroo mother care when compared to conventional methods of care.

The study revealed that hospital KMC for stabilized LBW infants 1000-1999g is at least as effective and safe as CMC, and shows that it is feasible in different settings, acceptable to mothers of different cultures and less expensive [6] .

Skin to skin contact from birth versus conventional incubator for physiological stabilisation in 1200-2199g newborns

Bergman NJ et al from University of Capetown, South Africa using a randomized control trial analysed 34 infants and concluded that newborn care provided by skin to skin contact on the mother's chest results in better physiological outcomes and stability than the same care provided in closed servo controlled incubators [7] .

Kangaroo Mother Care initiative in India-Where are we?

In a study conducted by Parikh TB et al at Department of Neonatology, Seth GS

Medical College and KEM Hospital, Mumbai to assess the knowledge and practices about Kangaroo mother care amongst health care personnel caring for newborn babies, it was found that the present knowledge of the health care personnel about preterm babies and Kangaroo mother care was unsatisfactory

EVIDENCE FOR KMC

There are more than 200 publications on KMC or skin to skin contact, which prove the beneficial effect of KMC. The various outcome variables studied include:

Mortality

Four published randomized controlled trials (RCT) comparing KMC with conventional care have been conducted in low-income countries [8-11]. The results showed no difference in survival between the two groups. Although the evidence shows that KMC does not necessarily improve survival, it does not increase mortality. Since KMC is usually initiated after stabilization and most of the neonatal mortality has already occurred by then, KMC is unlikely to affect the neonatal mortality. There are no studies evaluating the use of KMC as the primary and initial modality in the care of low birth weight infants in the community.

- **Breast-feeding**

  Four randomized controlled trails and a cohort study carried out in low-income countries looked at the effect of KMC on breast-feeding[8,10,11,12]. Three studies

found that the method increased the prevalence and duration of breast-feeding. Effects were more dramatic in areas with low breast-feeding rates.

- **Thermal control and metabolism**

  Four studies[12-15] carried out in low-income countries showed that prolonged skin to skin contact between mother and her preterm/LBW infant provided effective thermal control and was associated with reduced risk of hypothermia.

- **Growth**

  In one RCT, no difference in growth was observed at one year of age[8]. However two subsequent RCTs [10,12] have shown that infants cared for by KMC have a slightly better daily weight gain during their hospital stay.

- **Seriousmorbidity**

  Two RCTs have shown a lower rate of serious illness and hospitalization with use of KMC in first year of life[8,11]. However, there was no effect on mild to moderate infection.

- **Other effects**

  KMC helps both infants and parents. Mothers have reported significantly less stress during kangaroo care than when baby is receiving conventional care. They have described a sense of empowerment, confidence and a feeling that they can do something positive for their preterm infants in different settings and cultures.

Fathers too said that they feel relaxed, comfortable and contended while providing kangaroo care.

- **Acceptability**

  KMC was acceptable to health-care staff, and the presence of mothers in the ward did not seem to be a problem[12]. Most health workers considered KMC to be beneficial.

Feasibility of kangaroo mother care in Mumbai

In a study conducted by Kadam Sandeep et al at Lokmanya Municipal Medical College and General Hospital, Sion, Mumbai, India to determine the feasibility of kangaroo mother care in Mumbai ,it was concluded that KMC is a simple and feasible intervention; acceptable to most mothers admitted in hospitals. There may be benefits in terms of reducing the incidence of hypothermia with no adverse effects of KMC demonstrated in the study [16].

Comparison of skin-to-skin care and traditional care: parenting outcomes and preterm infant development.

Feldman R et al in a study in The Department of Psychology, Bar- Ilan University, Israel concluded that KMC had a significant positive impact on the infant's perceptual- cognitive and motor development and on the parenting processes. They stated that KMC has both a direct impact on infant development by contributing to

neurophysiological organization and an indirect effect by improving parental mood, perceptions and interactive behaviour.

In a study conducted by K. Ramanathan et al, at the All India Institute of Medical Sciences, New Delhi, it was concluded that KMC managed babies had better weight gain, earlier hospital discharge and, more impressively, higher exclusive breast-feeding rates. KMC is an excellent adjunct to the routine preterm care in a nursery.

OBJECTIVES OF THE STUDY

1) To compare the effects of both kangaroo care and conventional care on physiological parameters namely

   - Weight gain
   - Oxygen Saturation
   - Temperature maintenance

   and to see if kangaroo care had any beneficial or deleterious effects as compared to conventional care.

2) To assess the acceptance of KMC from maternal point of view by assessing mother's satisfaction and preference

STUDY JUSTIFICATION

Though there have been several studies done comparing the effects of kangaroo mother care with conventional methods of care, either incubator or open radiant warmer care in the care of low birth weight infants, these studies have been done in foreign countries.

In our country neonatal mortality rate remains high in spite of the decline in the child mortality rate, a significant number of this being contributed by low birth weight.

Also, conventional methods of care require maintenance of equipment, staff and manpower, which in our country is limited. Kangaroo mother care is a more economical alternative in these terms and if shown to be effective in caring low birth weight infants can be applied in several tertiary care centers of our country.

Kangaroo mother requires the placement of the baby directly on the mother's breast for several hours a day, which should be acceptable by the mother.

Also in a culturally conservative society like India, the placement of the baby on the breast and mere covering of the baby and the breast by a bag or a pallu brings about certain restrains in its acceptability.

Our study has included the mother's preference and satisfaction and has endured its test in our society.

The present knowledge of the health care personnel as well as the society about preterm and Kangaroo mother care is unsatisfactory and if shown to be acceptable in our society, it can be used to implement interventions like awareness programmes and training in Kangaroo mother care.

MATERIALS AND METHODS

Study design

An open randomized control study in which infant mother dyads are subjected to either of conventional methods of care or kangaroo mother care

Settings

Neonatology Division of The Institute of Child Health and Hospital for Children ,Egmore, Chennai

Participants

50 infants who fulfilled the inclusion criteria were selected in each group. Group 1 receiving Kangaroo mother care and Group 2 receiving Conventional method of care in open radiant warmers. The 50 mother infant dyads were observed for a period of seven days each.

Study duration

November 2005 to May 2007

Statistical Methods

Characteristics of infants included in the present study were tabulated as averages (means) with standard deviation (SD). For the physiological parameters, the average readings in the KMC and CMC group for each parameter (oxygen saturation, temperature and weight gain) were compared with by unpaired, two-tailed 't' test and chi2 test wherever applicable. The analysis was done using the SPSS version 11 for windows.

Inclusion criteria

Neonates with birth weight 1000 to 1800 gm

Exclusion criteria

Critically ill babies requiring ventilatory support, oxygen, inotropic support

Critically ill mothers unable to be with their babies due to medical illness

Multiple gestation

Chromosomal and life threatening congenital anomalies

Mothers unwilling to participate in the study

Manouevere

Randomized controlled trial in a major tertiary care centre in Chennai was performed over a period of one and a half years from 1st November 2005 to 31st May 2007.

All neonates with birth weight of 1000 to 1800 gm, stable cardiopulmonary status in air, Apgar's score of 7 at 5 minutes and on feeds (breast feeds or spoon *wati* feeds with expressed breast milk) were included in the present study.

Neonates, who fulfilled the inclusion criteria, were eligible for enrolment and written informed consent was taken from all mothers, after which babies were randomized, by the sealed envelope method into one of the two groups; group I being Kangaroo Mother Care (KMC) and group II being Conventional Method Care (CMC) under open radiant warmer. The sample size was not calculated in this study as this is considered as a pilot study.

Details of the antenatal period and delivery were recorded. Gestational age was assessed in both the groups by the new Ballard's score, within 24 hours of life by a single observer. Babies were weighed immediately after birth, length was measured at 24 hours of life with an infantometer and head circumference was measured at 48 hours of life with a non-stretchable cloth tape by the same observer.

In the KMC group the baby was placed on mother's chest in between the breasts in vertical position supported by a cloth designed for this purpose by the hospital, with mothers sitting in a semi-reclining position. KMC was given for a minimum of one hour at a stretch and continued for as long as comfortable to the baby and mother.

The weights of the babies were recorded daily using the electronic weighing scale.

Babies were continuously monitored for oxygen-saturation and heart rate by pulse-oximeter and the saturation of oxygen was recorded twice daily for a period of 7 days.

Axillary temperature was measured by keeping the bulb of the thermometer in the axilla and the thermometer kept vertically along the long axis o f the body. It was taken twice in a day at 7am and 7pm for three minutes during the observation period in kangaroo care and episodes of hypothermia (temperature 36^{o} C) was recorded.

Babies were monitored for apnea, sepsis, hyperbilirubinemia, serious illness, onset of breastfeeding, weight gain . KMC was discontinued if infant demonstrated 'discomfort', crying, pushing out legs or the mother was uncomfortable.

All babies assigned to CMC group were managed under radiant warmers. Mothers in both groups were allowed to enter and handle the babies at any hour of the day, change diapers and breastfeed the babies. Babies were discharged from the hospital when they were maintaining temperature without need for warmer, feeding well on breastfeeds or *wati* spoon-feeds and mother confident of taking care of the baby at home.

To check the acceptability of kangaroo care by the mothers, a semi structured questionnaire for interview with mothers about the feelings and acceptability was conducted at the end of the study.

QUESTIONNAIRE FOR MOTHER

1. Are you happy with the assignment?

2. Do you feel comfortable?

3. Do you find the method convenient?

4. Do you feel worried about the baby?

5. Do you find the method easy?

6. Do you feel you will be able to care for the baby at home?

7. Do other members in the family agree with this method?

PROFORMA

Name	:
IP NO	:
Address	:
Date of birth	:
Date of admission	:
Date of entering the study	:
Date of discharge	:
Birth weight	:
Sex	:
Mode of delivery	:
APGAR at 1’	:
APGAR at 5’	:
Resuscitation at birth	:

Consanguinity :

Parity :

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Sao2							
Temperature							
Weight							

RESULTS

During the study period of November 2005 – May 2007, 100 infants with birth weight ranging from 1000 to 1800 grams were chosen and grouped into Group1 who received KMC and Group 2 who received CMC under open radiant warmer.

The data from these mother infant dyads were analysed using SPSS for windows version 11.0.

The results of the analysis are as follows:

1. **Comparison of oxygen saturation in the kmc and cmc group**
2. Comparison of mean daily weight gain in the kmc and cmc group
3. Comparison of body temperature in the kmc and cmc group
4. Comparison of episodes of hypothermia in kmc group and cmc group
5. Comparison of mother's satisfaction in the kmc and cmc group

1. COMPARISON OF OXYGEN SATURATION IN THE KMC AND CMC GROUP

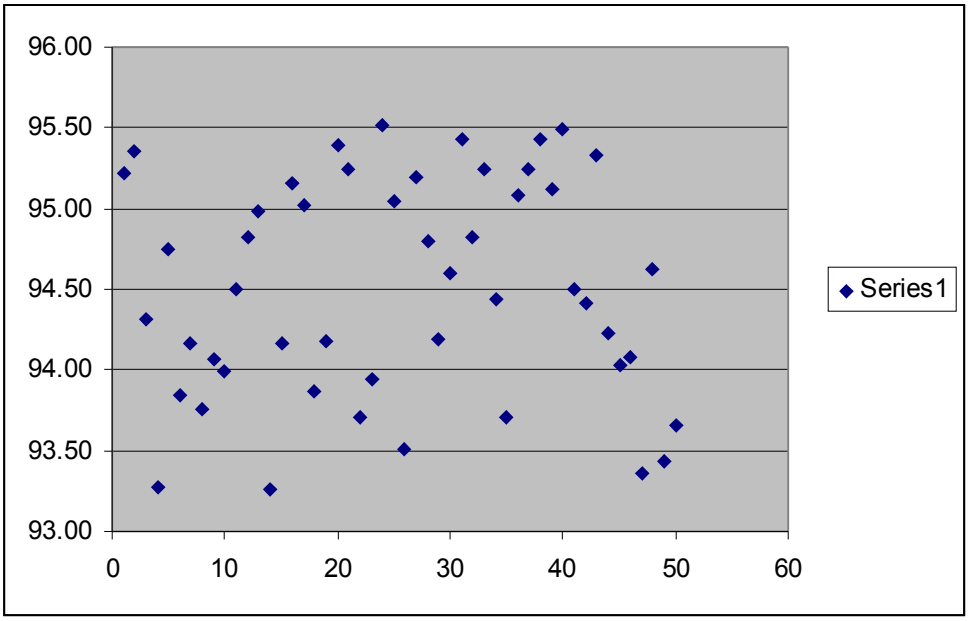
Table-1:

OXYGEN SATURATION IN THE KMC AND CMC GROUP

Care	OXY SAT (n(50))		P value
	MEAN	SD	
KMC	94.5104	0.6772	< 0.01
CMC	92.652	0.5138	

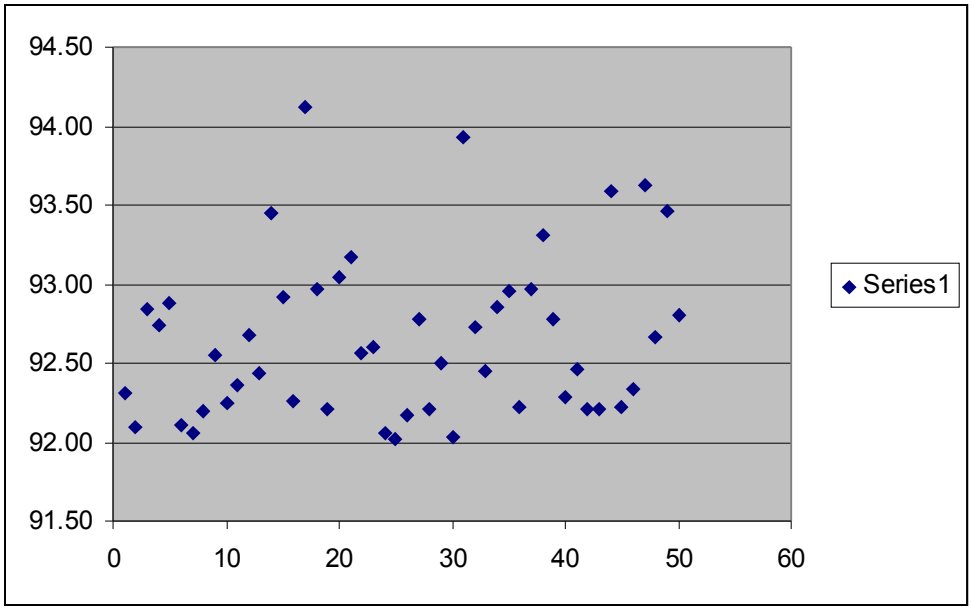
Of the 50 babies in the KMC group, the mean saturation of oxygen was 94.51% whereas in the CMC group it was 92.65% with a 'p' value of <0.01 which is statistically significant

OXYGEN SATURATION IN KMC GROUP



The mean saturation in the KMC group was 94.51 with a range of 93.26 to 95.52 percent.

OXYGEN SATURATION IN THE CMC GROUP



The mean saturation of oxygen in the CMC group was 92.65 with a range of 92.03 to 94.12 percent.

2. COMPARISON OF MEAN DAILY WEIGHT GAIN IN THE KMC AND CMC GROUP

Table-2 :

MEAN DAILY WEIGHT GAIN IN THE KMC AND CMC GROUP

CARE	WTGAIN (n(50))		P value
	MEAN	SD	
KMC	9.222	2.778	< 0.01
CMC	6.946	2.519	

The mean daily weight gain in the KMC group was 9.222 grams as against 6.946 grams in the CMC group with a'p' value of 0.0001.

3. COMPARISON OF BODY TEMPERATURE IN THE KMC AND CMC GROUP

Table3 :

BODY TEMPERATURE IN THE KMC AND CMC GROUP

CARE	BODYTEMP (n(50))		P value
	MEAN	SD	
KMC	37.12	0.56	Not significant
CMC	37.08	0.7	

The mean body temperature in the KMC group was 37.12 as against 37.08 in the CMC group which is not statistically significant.

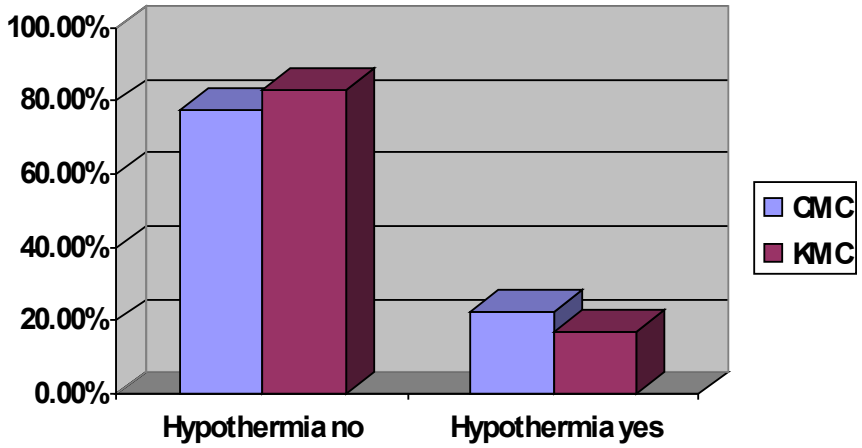
4. EPISODES OF HYPOTHERMIA IN KMC GROUP AS COMPARED WITH CMC GROUP

Table 4 :

EPISODES OF HYPOTHERMIA IN KMC GROUP AS COMPARED WITH CMC GROUP

Care	Hypothermia episodes		TOTAL
	NO	YES	
CMC	542(77.40%)	158(22.60%)	700(100%)
KMC	581(83%)	119(17%)	700(100%)
TOTAL	1123	277	1400

The episodes of hypothermia measured twice a day for one week were 119 in the KMC group (17%) as against 158 (22.6%) in the CMC group with relative risk in the CMC group being 1.33 times that in KMC group



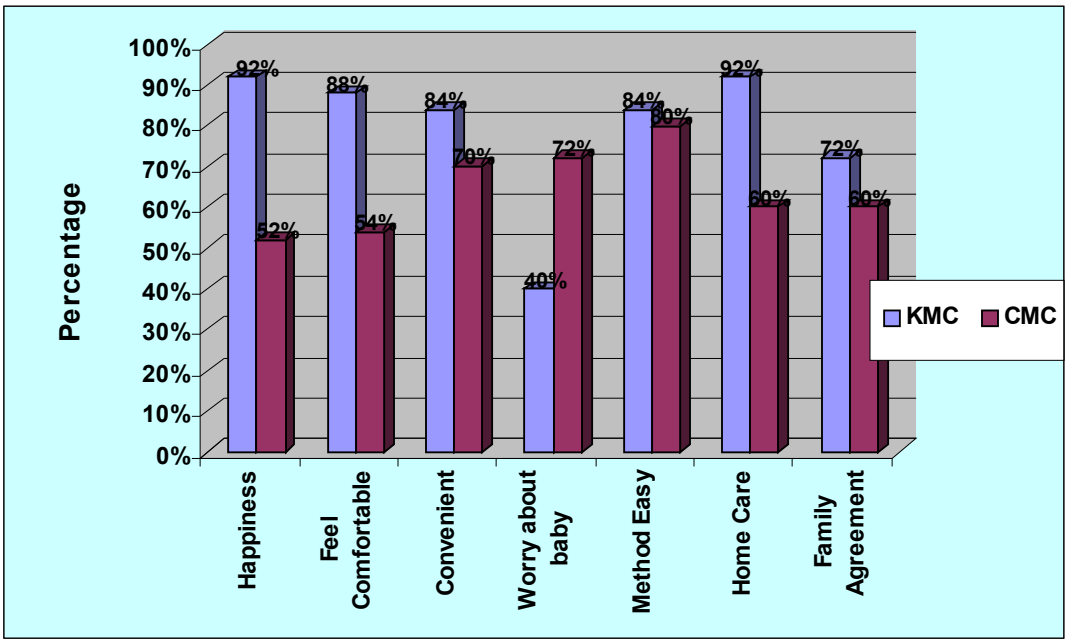
	VALUE	95% confidence interval	
		Lower	Upper
Relative Risk(RR) for method of care (CMC/ KMC	0.70	0.54	0.92
Cohort Hypothermia Episodes = No	0.93	0.89	0.98
Cohort Hypothermia Episodes = Yes	1.33	1.07	1.64

The episodes of hypothermia measured twice a day for one week were 119 in the KMC group (17%) as against 158 (22.6%) in the CMC group with relative risk in the CMC group being 1.33 times that in KMC group.

The 'p' value in this is less than 0.01, hence the episodes of hypothermia are significantly less in the KMC group.

5. COMPARISON OF MOTHER'S SATISFACTION IN THE KMC AND CMC GROUP

TABLE 3:MOTHER'S SATISFACTION



In the mothers in the KMC group, 92% (46 of the 50) were happy with the assignment whereas 52%(26 of the 50) in the CMC group were happy with the assignment. 88% (44 of the 50) in the KMC group as against 54%(27 of the 50) in the CMC group were comfortable with the method.

84% (42 of the 50) in the KMC group felt it convenient as against 70% (35 of the 50) in the CMC group.

When worry about the baby and its recovery was questioned, only 40%(20 of the

50) mothers in the KMC group were worried as against 72%(36 of the 50) in the CMC group.

84%(42 of the 50) in the KMC group found the method easy as against 80%(40 of the 50) in the CMC group.

92% (46 of the 50) of the mothers in the KMC group felt that they would be able to care for the baby at home whereas only 60% (30 of the 50) of the mothers in the CMC group were able to do so.

When asked if other members in the family agreed with the method, 72% (36 of the 50) in the KMC group as against 60% (30 of the 50) felt that their family members agreed with the method.

DISCUSSION

A randomized-controlled trial was performed in Newborn unit of our hospital which is a major teaching hospital in Chennai over a one and a half year period. Babies whose birth weight was between 1000 to 1800 grams who fulfilled our inclusion criteria and had stable cardiopulmonary status and mothers who were willing to participate in the study were taken into the study. 50 infant mother dyads in each group were studied and physiological parameters namely oxygen saturation, temperature and weight gain was recorded. The mother's satisfaction was recorded in the form of a questionnaire at the end of the study. The demographic characteristics in both KMC and CMC groups were comparable for the gestational age, birth weight, and anthropometry. The type of milk and the method of feeding were similar in both the groups with more than 95 % of babies receiving exclusive breastfeeds and the remaining were supplemented by banked human milk.

Babies in KMC group had lesser episodes of hypothermia as compared to CMC group (119 vs 158) and this was statistically significant and also is similar to observations were made by Cattaneo et al., and Ludington-Hoe et al.,[17,18] Baby is in contact with warm maternal skin and receives heat from mother's breast on each side and from her chest in front and rise in skin temperature is as a result of conductance of heat from mother to the infant[19.] This is due to the phenomenon of thermal synchrony which is maintained in Kangaroo mother

care.

Placement of the infant underneath a blouse or shirt improved insulation and prevents heat loss during the maternal kangaroo care. Higher temperature in the skin-to-skin contact in the present and the earlier studies provide evidence that maternal body is an efficient heat source for the baby.

Babies in the KMC group had significantly higher oxygen saturation as compared to the CMC group (94.51 vs 92.652) and these findings are in accordance with Acolet et al., Bier et al., and Fohe et al.,[20,21,22]

Babies who were allotted in the KMC group had higher mean daily weight gain than the babies in the CMC group (9.222 grams as against 6.946 grams) and this was statistically significant and also is similar to observations were made by Cattaneo et al.,[17]

Mothers whose babies were allotted in the KMC group were more happy and comfortable with the assignment and were confident of taking care of the baby at home. These findings are in accordance with the study by Cattaneo et al.,[17] and Kadam Sandeep et al.,[16.] This observation has proved that Kangaroo mother care is acceptable to the mothers in our society and hence feasible.

CONCLUSION

- ✓ Kangaroo mother care produces better daily weight gain than conventional methods of care .
- ✓ Kangaroo mother care helps in better maintenance of oxygen saturation than conventional methods of care.
- ✓ Kangaroo mother care has benefits in terms of reducing the incidence of hypothermia.
- ✓ KMC is a simple and feasible intervention; acceptable to most mothers admitted in hospitals.
- ✓ The present study has important implications in the care of LBW infants in the developing countries, where expensive facilities for conventional care may not be available at all places.

BIBLIOGRAPHY

1. WHO. Low birth weight. A tabulation of available information.Maternal Health and Safe Motherhood Programme (WHO/MCH/92.2),Geneva,1992.

2. WHO.Mother-baby package:implementing safe motherhood in countries. Maternal Health and Safe Motherhood Programme (WHO/FHE/MSM/94.11),Geneva,1994.

3. John P. Cloherty, Eric C. Eichenwald, Ann. R. Stark -Manual of neonatal care 5th edition-Pages 147-150.

4. Rey ES, Martinez HG.Manejo racional del nino premature. In: Cursode Medicina Fetal, Universidad Nacinal, Bogota, Colombia, 1983.

5. Whitelaw A, Sleath K. Myth of the marsupial mother: home care of very low birthweight infants in Bogota, Colombia. Lancet 1985; 25; 1(8439): 1206-1208.

6. Acta Paediatrica, Volume 87, Number 9,18 September 1998, pp 976-985(10).

7. Acta Paediatrica, Volume 93, 1 6/June 2004Pages 779-785

8. Charpak N, Ruiz-Pelaez JG, Figueroa de CZ, Charpak Y. A randomized controlled trail of kangaroo mother care: results of follow-up at 1 year of corrected age. Pediatrics. 2001 Nov; 108(5): 1072-9.

9. Kambarami RA, Chidede O, Kowo DT. Kangaroo care versus incubator care in the

management of well preterm infants- a pilot study. Ann Trop Paediatr. 1998 Jun; 18(2): 81-6.

10. Cattaneo A, Davanzo R, Bergman N, Charpak N. Kangaroo mother care in low income countries. International Network in Kangaroo Mother Care. J Trop Pediatr. 1998 Oct;44(5):279-82.

11. Sloan NL, Camacho LW, Rojas EP, Stern C. Kangaroo mother method: randomised controlled trial of an alternative method of care for stabalised low-birth weight infants. Maternidad Isidro Ayora Study Team. Lancet. 1994 Sep 17; 334(8925):782-5.

12. Ramanathan K, Paul VK, Deorari AK, Taneja U, George G.Kangaroo Mother Care in very low birth weight infants. Indian J Pediatr. 2001 Nov;68(11):1019-23.

13. Chwo MJ, Anderson GC, Good M, Dowling DA, Shiau SH, Chu DM. A randomized controlled trial of early kangaroo care for preterm infants: effects on temperature, weight , behaviour and acuity. J Nurs Res. 2002 Jun;10(2):129-42.

14. Legault M, Goulet C. Comparison of kangaroo and traditional methods of removing preterm infants from incubators. J Obstet Gynecol Neonatal Nurs. 1995 Jul-Aug;24(6):501-6.

15. Johanson RB, Spencer SA, Rolfe P, Jones P, Malla DS. Effects of post-delivery care

on neonatal body temperature. Acta Paediatr. 1992 Nov;81(11):859-63.

16. Kadam Sandeep, Binoy S, Kanbur Wasundhara, Mondkar JA Fernandez Armida. Feasibility of Kangaroo Mother care in Mumbai. The Indian Journal of Paediatrics,Year 2005, Volume 72, Issue 1.

17. Catteneo A, Davanzo R, Worku B et al. Kangaroo mother care low birthweight infants: a randomised controlled trial in different settings. Acta Pediatr 1998; 87: 976-985.

18. Ludington-Hoe SM, Hashemi MS, Argote LA et al. Selected physiological measures and behaviour during paternal skin contact with Columbian preterm infants. J Dev Physiol 1992; 18(5): 223-23

19. Ludington SM. Energy conservation during skin-to-skin contact between premature infants from incubators. J Obstet Gynecol Neonatal Nurs 1995; 24 (4): 295.

20. Acolet D, Sleath K, Whitelaw A. Oxygenation, heart rate and temperature in very low birth weight infants during skin-to-skin contact with their mothers. Acta Pediatr Scand 1989; 78(2): 189-193.

21. Bier JA, Ferguson AE, Morales Y et al. Comparison of skin-to-skin contact with standard contact in low birth weight infants who are breast-fed. Arch Pediatr Adolesc

Med 1996; 150(12): 1265-1269.

22. Fohe K, Kropf S, Avenarius S. Skin-to-skin contact improves gas exchange in premature infants. J Perinatol 2000; 20(5): 311-315.